



A geochemical approach to glacial sediment provenance in Northern Ireland

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1. Introduction

Dear IQUA member,

Welcome to Newsletter no. 49.

We had a very successful spring meeting at the school of Geography, Archaeology and Palaeoecology, Queen's University Belfast. The conference was followed by a wine reception sponsored by the 14CHRONO Centre and a fascinating tour of their facilities. We would like to thank Rory Flood for organising such a stimulating meeting and Queen's University and the 14CHRONO Centre for their warm welcome and sponsorship of the day. Thanks also to all who attended the Spring Meeting and AGM. An excellent programme of speakers (see abstracts below under item 4) provided an inspiring and entertaining set of talks on Quaternary research. Paula Reimer of the School of Geography, Archaeology and Palaeoecology, QUB delivered a keynote address entitled: "Reliability of radiocarbon dating mollusc shells from Irish sites". The student prize was presented to Michael Dempster, from the University of Ulster for his excellent presentation on 'A geochemical approach to glacial sediment provenance in Northern Ireland.' Thanks to all the speakers, and organisers of the meeting.

This year we have a few changes to the IQUA committee following the AGM (see item 2). Many thanks to Sarah Murnaghan for all her hard work on the editing of past IQUA newsletters and we would also like to welcome Susan Hegarty and Benjamin Thebaudeau as ordinary members.

The last few months have been very busy with many events associated with ESOF, Dublin City of Science and there promises to be some exciting trips, seminars, conferences and events in the latter half of 2012. These are all detailed in section 8 and 9. IQUA members have also been busy publishing on their current research as reported on in section

10. The programme for the annual fieldtrip to Co. Roscommon and South Sligo (7th - 9th September 2012) has been confirmed and promises a wide variety of themes to suit all interests (see item 5 for details)! IQUA's Autumn Symposium on 'Remote sensing: Applications in Quaternary science, archaeology and landscape management' will take place on 30th November 2012 and is sure to be yet another highlight for all (see item 3 for more information).

Thanks to all who contributed to this edition of the newsletter.

Kind regards,
Ellen OCarroll (Dept. of Botany, TCD)

2. IQUA Committee (2012/2013)

The IQUA Committee, following the 2012 AGM is as follows:

President: Prof Fraser Mitchell, TCD (continuing)
Secretary: Dr. Bettina Stefanini, NUIM (continuing)
Treasurer: Gayle McGlynn, TCD (continuing)
Postgrad rep: Rory Flood, QUB (continuing)
Website manager: Dr. Francis Ludlow, TCD. (continuing)
Publications Secretary: Gayle McGlynn, TCD (continuing)
Newsletter editor: Ellen OCarroll, TCD (elected)
Ordinary members: Dr. Steve McCarron, NUIM (continuing), Sarah Murnaghan, TCD (continuing), Dr. Steve Davis, UCD (elected), Susan Hegarty, St. Patricks College, Drumcondra (elected), Benjamin Thebaudeau, TCD (elected)

3. IQUA Autumn Symposium 2012

IQUA Autumn Symposium 2012:

Remote sensing: Applications in Quaternary science, archaeology and landscape management.

Venue: Geological Survey of Ireland Lecture Theatre, Ballsbridge, Dublin 4.

Date: Friday 30th November 2012

This autumn's meeting is on "Remote sensing: Applications in Quaternary science, archaeology and landscape management" and will include presentations on both terrestrial and airborne geophysical survey, LiDAR in management contexts and satellite imagery. Speakers will be from a variety of settings, including private sector (Kevin Barton - LGS), Paul Gibson (NUI Maynooth; Discovery Programme), Michael Sheey (Tellus Project, GSI) and public sector Conor Galvin - OPW). The keynote address will be presented by Prof. Michael Doneus, Director of the Vienna Institute of Archaeological Science and Deputy-Director and Key-Researcher at the Ludwig Boltzmann Institute for Archaeological Prospection and virtual Archaeology. All queries and suggestions should be directed to Steve Davis (stephen.davis@ucd.ie) or Bettina Stefanini (stefanb@tcd.ie).

4. IQUA Spring Meeting and AGM 2012

The Spring Meeting and AGM was held on Saturday the 14th of April, 2012 in the School of Geography, Archaeology and Palaeoecology, Queen's University Belfast. The meeting was well attended and Prof Paula Reimer keynote talk ("Reliability of radiocarbon dating mollusc shells from Irish sites".) was very well received and provided much insightful discussions afterwards. Talks covered a broad variety of topics, and included presentations on environmental change and ecological responses to climate change from many areas of the world including the Virunga volcanoes in the Albertine Rift, central Africa, South America and North west

Ireland. Talks on the large glacio-tectonic raft of Carboniferous Limestone in Killala Bay as well as the British-Irish Ice Sheet and four Vibrocores from Galway bay were also presented. Abstracts of talks are listed under item 6. Congratulations to the winner of the Postgraduate Prize for the best talk, to Michael Dempster, from the University of Ulster for his excellent presentation on 'A geochemical approach to glacial sediment provenance in Northern Ireland.' The committee would like to extend their appreciation to Rory Flood and Paula Reimer for providing a great reception and tour of the 14CHRONO Centre. The 14CHRONO Centre contained a huge array of very specialised and highly technical equipment. We were all very impressed! The IQUA AGM followed the Spring Meeting. There were only a few changes made to the committee which included a new newsletter editor as well as two newly elected ordinary committee members (see item 2 for details). Thanks to all outgoing committee members, and best of luck to those elected to new positions.



Spring meeting attendees inspect the equipment at the 14CHRONO Centre

5. IQUA 2012 Annual Fieldtrip to Co. Meath

Bettina Stefanini, Geography Department, NUI Maynooth.

I am delighted to announce this year's IQUA Field Meeting in Co Roscommon and south Sligo on September 7-9th. The Meeting will introduce us to

outstanding karstic landscape features of Co Roscommon and its rich glacial geology. We will come eye to eye with turlough life and the enigmatic pitfields. We will hear about the Famine in Roscommon and discover the complex monuments near Tusk and Rathcroghan. There will even be a chance to slip into the otherworld through Oweynagat's Cave. On Sunday we will visit the Bricklieve Mountains of south Sligo, explore their geology and follow the exciting new work on the least known of the Irish megalithic complexes. We will find out about what was so important about the Neolithic farming economy from new high resolution pollen work in this region.

Programme stops:

Friday evening 8pm in Tully's Hotel, Castlerea: Mary Kelly will talk about her work on how the famine affected Co Roscommon and Kevin Barton will give us a fascinating introduction to the possibilities and realities of the geophysical explorations of the Rathcroghan Mound.

Saturday morning: Brian Shanahan: Archaeology of the Rathcroghan area and the work of the Discovery Programme in Tusk. Robbie Meehan: Glacial features and David Drew and Caoimhe Hickey: karst in the area. Kevin Barton: Exploring the Rathcroghan Mound and pitfields. Gary Dempsey: On the very special place that is Oweynagat's Cave.

Lunch: Cruachan Ai Heritage Centre, Tusk

Saturday afternoon: Sarah Kimberley and Nova Sharkey: Brierfield Turlough how it works and what grows there. David Drew and Caoimhe Hickey: The Mewlaghmore dolines and karst of the Longford Springs. Robbie Meehan: Glacial Castlerea.

Sunday: Robert Hensey: New dates and interpretations of the Carrowkeel complex. Susann Stolze Neolithic economy through the palaeoecology of four lake sites and Robbie Meehan: Glacial legacy of the Bricklieves.

Please arrange your own accommodation, see below for a list of possibilities. Transport: There is a train to Castlerea but transport will be by private car throughout the trip. Let me know if you need a seat or have space in your car for somebody. The fee is €20/30 for members/non-members and €10/15 for student members/non-members this includes a printed field guide.

Accommodation Castlerea:

Tully's Hotel, small hotel in the centre of Castlerea: phone 094 962 0200

Fallon's B&B, phone: 094 962 1183

Armcashel B&B, www.armcashel.com phone: 094 962 0117

Ronanae's B&B 094 962 0431

Clonalis House is a Historic House that does B&B, <http://clonalis.com/> phone: 094 962 0014

Please register your interest with Bettina Stefanini (email: stefanb@tcd.ie or phone 087 218 0048) to secure your place on the trip.

6. IQUA 2012 Spring Meeting Abstracts

Keynote talk

Reliability of radiocarbon dating mollusc shells from Irish sites

P.J. Reimer^a, G. J. McClean^{a,b}, D. W. Beilman^{a,c} and S. E. Crow^{a,c}.

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Marine mollusc shells are frequently found in coastal and glacial deposits as well as archaeological sites throughout Ireland. Our ability to reliably use radiocarbon dates of mollusc shells to estimate calendar ages depends in part on the feeding preference and habitat of the particular species and the geology of the region (Mangerud, 1972). Marine mollusc shells are formed primarily from dissolved inorganic carbon (DIC) in seawater but in some species a portion of metabolic carbon is incorporated into the shell (Tanaka et al. 1986). Gastropods which graze on algae living on carbonate rocks are particularly prone to incorporation of carbon from the substrate into their shells (Dye et al. 1994). Measurements of mollusc shells and flesh collected live on limestone and basalt on the east and west coasts of Ireland indicate there is no substrate carbonate

incorporated into the shells of the limpets (*Patella* sp.) but raise doubts about the reliability of periwinkles (*Littorina littorea*) for radiocarbon dating. The results will have an important consequence for radiocarbon dating of geological and archaeological deposits as well as the bones of humans and animals who fed on the molluscs.

References:

- Dye, T., 1994. Apparent ages of marine shells: implications for archaeological dating in Hawai'i. *Radiocarbon* 36: 51-57.
- Mangerud, J., 1972. Radiocarbon dating of marine shells, including a discussion of apparent age of Recent shells from Norway. *Boreas*, 1: 143-172.
- N. Tanaka, M. C. Monaghan, and D. M. Rye, *Nature* **320**, 520 (1986)

Out of tune: the dangers of aligning proxy archives

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Abstract

Tuning is a widespread technique to combine, date and interpret multiple fossil proxy archives through aligning supposedly synchronous events between the archives. The approach will be reviewed by discussing a number of literature examples, ranging from peat and tephra layers to orbital tuning and $\delta^{18}\text{O}$ series from marine and ice deposits. Potential problems will be highlighted such as the dangers of circular reasoning and unrecognised chronological uncertainties, and some solutions suggested. Fossil proxy research could become enhanced if tuning were approached in a more quantitative, reliable and objective way, and especially if individual proxy archives were non-tuned and kept on independent time-scales.

Sediment-based evidence for Holocene environmental change from the Virunga volcanoes in the Albertine Rift, central Africa

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Environmental changes in the Albertine Rift, including the effects of both long-term climate change and human activity, post a potentially

serious risk in one of the world's most biodiverse areas. This study presents new well-dated sedimentary pollen and charcoal evidence from two high-altitude crater sites in the Virunga volcanoes, a group of mountains associated with the Albertine Rift: a ca. 8000-year record from a crater swamp at an altitude of 3474 m, and a ca. 2800-year record from a crater lake at an altitude of 4127 m.

Sediment-based evidence from the two crater sites shows that climate changes linked to variations in monsoonal activity during the mid-Holocene were an important driver of vegetation changes, both at high-altitude sites and more widely in adjacent parts of the Albertine Rift, with impacts apparently amplified by concurrent changes in fire regimes. An asynchronous timing of vegetation changes highlights the differential lag effects of responses of plant taxa to climate variability. Human-induced environmental change in the Albertine Rift is apparent only within the last millennium, despite the long history of human occupation of the area. Both study sites record significant forest clearance at ca. 900 cal yrs BP, involving a reduction in lower montane forest taxa and increases in disturbance indicators. Other significant changes in the upper montane forest, possibly linked to anthropogenic changes in the fire regime, are also apparent from ca. 900 cal yrs BP. Human-induced environmental modification from the early part of the last millennium, likely associated with onset of the Late Iron Age, appears to have extended to high altitudes, which were previously assumed to be pristine. The role of natural, long-term climate change as a major cause of environmental change in the Albertine Rift has been eclipsed within the last millennium by human-induced environmental effects, and this has implications for current conservation strategies.

Ecological impacts of early farming in western Ireland: a palaeolimnological approach

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Abstract

This research provides an insight into both the effects and intensity of Neolithic and Bronze Age farming practices through a multi-proxy analysis of a lake sediment core from northwest Ireland. Palaeoenvironmental proxy evidence includes chironomid and stable isotopic analysis of carbon and nitrogen ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$, and C:N). These proxies were successful in detecting various prehistoric human impacts in the lake catchment, and will help to inform early farming practices in the region. This study emphasizes the usefulness of chironomids in

archaeological research. Results from the chironomid analysis show that the first substantial period of agricultural activity during the Early Neolithic resulted in a temporary shift to more eutrophic lake conditions. The chironomid community then reverted back to its pre-impacted state following a decline in agricultural activity in the Middle to Late Neolithic. Following a second, more intensive, period of agricultural activity in the Late Neolithic/Early Bronze Age, lake trophic status was more permanently altered, even during an agricultural hiatus at the end of the Early Bronze Age to the Middle Bronze Age. This study also provides evidence of possible manuring during the Early Neolithic, as indicated by increased levels of $\delta^{15}\text{N}$ and decreased levels of $\delta^{13}\text{C}$ and C:N during this time. Increased sedimentation rate, along with increases in $\delta^{13}\text{C}$, $\delta^{15}\text{N}$, and C:N, the presence of chironomid taxa indicative of erosion and more eutrophic lake conditions, all point to more intensive land use practices during the Bronze Age.

A geochemical approach to glacial sediment provenance in Northern Ireland

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Abstract

Reconstruction of flow patterns for the Irish Ice Sheet has traditionally relied heavily on the interpretation of subglacial bedforms, namely ribbed moraines and drumlins. Recent research has demonstrated the interpretation of these landforms may at times be misleading, particularly over small sample areas. Furthermore not all areas of glaciated terrain experienced or retain evidence of a bedforming event. An alternative approach independent of bedform presence is to use geochemistry to establish glacial sediment provenance and hence ice flow direction. This project has used geochemistry of soil developed on till to investigate glacial sediment provenance in Northern Ireland. Principal Component Analysis has been applied to the Tellus Survey soil geochemical database for samples taken on areas of till superficial geology in the region. This approach allows identification of groups of chemical elements that can be linked to likely parent bedrock material for the till. The regional results show glacial transport and that the majority of till deposits in Northern Ireland are closely related to local

bedrock, with rapid geochemical changes at lithological boundaries. This suggests till transport rates in this sector of the Irish Ice Sheet were low, with rapid entrainment and low evacuation rates of debris to the ice margin.

An assessment of recent climate change and ecological response in NW Ireland using chironomid-based palaeolimnological reconstructions

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Abstract

As anthropogenic climate warming becomes more apparent, it is important to assess the varying responses to this global phenomenon at the regional level. This paper examines the response of the chironomid community in three small low-mid elevation lakes in NW Ireland to changing summer temperature. Changes in the chironomid community from these sites were compared with a local temperature record dating from 1842. Sediment from all these sites was ²¹⁰Pb and ¹⁴C-dated. Chironomid assemblage data is obtainable at the sub-decadal level. A number of recent studies have examined the effects of recent warming on aquatic ecosystems, and have shown the chironomid community to be particularly responsive to this warming trend. However the bulk of these studies have been on high-elevation or high-latitude lakes, as these sites are known to be particularly responsive to climate change. This study will offer insight into the impact of recent climate change on chironomid communities in lakes situated in mid latitude locations at lower elevations. This approach will further clarify the sensitivity of lake systems to the more subtle, although still evident, warming trends experienced in less extreme locations.

Investigating late-glacial and Holocene environmental change in South America using phylogenetic and palaeoecological techniques

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Abstract

Holocene [ca. 12,000 years before present] climatic and environmental changes have played an important role in the distribution and genetic diversity of modern day vegetation. However, these changes in the Southern Hemisphere remain poorly understood and previous research is sparse and

often criticized. Modern day populations of *Lomatia hirsuta* are disjunct; the species is found in central Argentina and Chile, and Peru and Ecuador but is currently absent from northern Chile. The *Araucaria araucana* species is currently under threat from human activity such as forest clearance and grazing. The research will utilise chloroplast DNA and microsatellite markers of *Lomatia hirsuta* and *Araucaria araucana* to study the pattern of current distribution, coupled with the high-resolution analyses of pollen, charcoal and tephra within two lake sediment cores to investigate the environmental history of this region. It is anticipated that the research will provide insight into: 1) the timing and pattern of shifts in vegetation ecotones; 2) the frequency and regimes of fire in the region; 3) a history of volcanic activity in the region; 4) the post-glacial spread of *Lomatia hirsuta*, and finally; 5) the potential of combining phylogenetic analysis of *Araucaria araucana* and palaeoecological techniques to provide a richer understanding of environmental change in a region.

The offshore flow of the British-Irish Ice Sheet recorded by buried and exposed glacial features on the western Irish shelf

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OLEX bathymetric data, the high-resolution multibeam bathymetric and seismic data from the Irish National Seabed Survey and from additional surveys on the Irish continental margin have revealed extensive evidence for past ice sheet advance and retreat across the western Irish continental shelf. These marine geophysical data confirmed that the British-Irish Ice Sheet (BIIS) extended for at least 100-150 km offshore of west Ireland and Scotland onto the continental shelf and left a signature of drumlins, moraines and iceberg scours, both buried and at the seabed. These features provide unequivocal evidence for past extension of the BIIS to the shelf edge, reconfiguration of the ice sheet into a series of lobes during deglaciation, followed by subsequent slow retreat of grounded ice.

This talk will present an overview of the buried and exposed glacial features across the western Irish shelf, as well as report on the initial observations on sediment cores collected from these features.

An Examination of Four Vibrocores from Galway Bay – Preliminary Results

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Coastal sediment records can be used to track Holocene environmental change; including climate change, sea level rise, freshwater discharge and recent anthropogenic changes. An understanding of past, contemporary and future coastal systems requires temporal datasets that can integrate natural conditions and subsequent human induced deviations. This project is a paleoecological study, utilising the sediment record to link spatial and temporal data for coastal ecosystems and applies their use in the Galway Bay region. A transect of the inner bay silt/clay depositional areas <1.8km from the coast was targeted for core extraction. These sediments are being examined for their physical, chemical and biological properties and their response to bay dynamics, the range of natural variability and responses to unusual events. Sediment records portray amalgamated profiles of the extent of land-based activities, along with sedimentation rates, time marker horizons, geochemical signatures and biological responses represented in fossil assemblages. These assemblages provide an ecological track for further assessment of contemporary and future impacts. This presentation portrays the work completed to date: four Vibrocore samples have been examined and sedimentology, lithology and stratigraphy have been established; fourteen AMS ¹⁴C dates have been obtained, ranging from 535±22 to 11,699±41 years BP. On-going investigations include fossil assemblages, biochemical properties, salinity levels and sea-level variation. Based on these investigations, past climatic conditions and environmental change during the Holocene in Galway Bay will be assessed.

Sedimentary processes and provenance of the West Bengal Sundarbans: results and interpretations of facies dynamics

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Abstract

The Sundarbans, situated at the confluence of the River Ganges, Brahmaputra and Hughli serves as the primary habitat for many endangered wildlife species, including the Bengal Tiger. The primary aim of this project is to discern the sources, processes responsible and the rate of sedimentation taking place in this estuarine-deltaic

environment. A sedimentary facies analysis approach using the geochemical and sedimentological characteristics (powder x-ray diffraction, x-ray fluorescence and particle size analysis) of three cores retrieved from the south Sundarbans has shown quite distinctive mineralogical assemblages and grain size distributions. The mineralogical results from the three cores examined may represent two distinct pathways of sediment entering the Sundarbans; through the products of weathering in parent rock material introduced allochthonously and through some autogenic clay pedogenesis. Particle size analysis has been able to elucidate some of the processes behind sedimentation, in particular the role of tidal ebb and flow factors with the sedimentary sequences in the Sundarbans showing a progressive fining-up from the base to the surface of the cores collected. Radiocarbon (^{14}C AMS) dating has been undertaken in order to constrain some record on the rate of sedimentation taking place. The consensus regarding sedimentation in the Sundarbans has been held that these areas are 'cut-off' from a supply of detrital, terrigenous sources of sedimentation. However, the preliminary results developed with this project appear to challenge this assertion and show that there are dynamic, in-situ processes taking place within this system.

Reconstructing the last Newfoundland Ice Sheet through the last glacial cycle (~28ka-10ka yr BP)
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Abstract

Ice sheets are an integral part of the global climate system and are recognised as both responding to and driving climatic change. Concerns of instability and increased melting rates observed in contemporary ice sheets and the potential impact of these on global sea-levels, has led to a need to establish how ice sheets respond to external forcing over long-time periods. An established methodology is to use the glacial landform record to reconstruct palaeo-ice sheet behaviour which provides critical information on how ice-sheets respond to external forcing through entire glacial cycles. The former Newfoundland Ice-sheet is of particular significance due to its position on the fringes of the North Atlantic and the much larger North American Laurentide Ice Sheet. Analyses of this record can provide new information on wider ice sheet-ocean-atmosphere interactions in this region. The aims of this project are to systematically map the glaciated

landscape in Newfoundland using satellite remote sensing and use this data to reconstruct the dynamic history of the former Newfoundland ice sheet during the last glacial cycle. This poster presents the initial results from the mapping programme and shows the distribution of subglacial landforms in eastern Newfoundland which are used to reconstruct the former ice flow pathways.

A large glacio-tectonic raft of Carboniferous Limestone in Killala Bay, Co. Mayo

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Abstract

A glacio-tectonic raft complex >400 m long is exposed on the E side of Kilcummin Head. The largest element in the complex is a thrust sheet >300 m long and <14 m thick consisting of interbedded limestone (<1 m) and shaly units (<2 m). The northern 120 m of this thrust sheet is ramped up over a lower sheet of the same beds. Vertical joints in the limestones have locally developed into S-dipping "domino" faults, while the topmost bed of the raft is undeformed ("bookshelf faulting") reflecting ice-induced northward shear. Glacial striations are orientated N-S. The main thrust sheet is covered by blocky, sandstone-dominant, de-glacial-phase diamicts enclosing "floating" rafts <35 m long.

The northernmost 70 m of the cliff section consists of a stack sub-horizontal thrust sheets >30 m long. Each consists of a highly deformed shaly unit, capped by a little-deformed limestone, which at the N end forms an enclosing terminal overfold.

The extensive sub-horizontal form of these thrust sheets and the absence of listric faults indicate that the thrust sheets were emplaced successively upwards, not as piggy-backs.

Northward thrusting of the raft complex is in line with drumlin orientation through the Ox Mountains, but relative timing is unknown.

7. Notices

*** Bill Watts 14CHRONO Award 2012***

Congratulations to the winners of the Bill Watts 14CHRONO Award won by Thomas Roland, University of Exeter and Michelle McKeown, NUI

Galway. The next round of applications will be open until 31st October 2012. For more details, contact Bettina Stefanini (stefanb@tcd.ie).

Bill Watts 14CHRONO Award 2011

A Bill Watts 14CHRONO Award from IQUA in collaboration with ¹⁴Chrono Centre, QUB, financed three AMS ¹⁴C dates, is gratefully acknowledged by Beatrice Ghilardi and Michael O'Connell. These dates helped greatly in establishing a chronology for the record from Cooney Lough. A short article on the results is detailed below.

New evidence for unstable climate in Ireland during the early Holocene with particular reference to the 8.2 ka event

Beatrice Ghilardi and Michael O'Connell
Palaeoenvironmental Research Unit, School of Geography and Archaeology, NUI Galway

New pollen analytical evidence, the first from Ireland and Britain to clearly demonstrate a major climate anomaly some 8200 years ago (the so-called 8.2 ka event), has recently become available through investigations carried out on lake sediments retrieved from Cooney Lough, Co. Sligo. This small but relatively deep lake (maximum recorded depth: 8.6 m) lies 2 km west of Ballysadare, in the fertile lowland coastal strip between the Ox Mountains and Ballysadare Bay. The lake was cored by a NUIG/Kiel University coring team in April 2010. Two cores were collected from a raft anchored at the centre of the lake using an Usinger piston corer. While the focus of the investigations was reconstruction of prehistoric farming impact recorded in the upper part of the sediment sequence, preliminary investigations suggested that the lower part of the sequence contained a good record of early Holocene environmental change and especially the 8.2 ka climate anomaly. This anomaly, first recognised on the basis of oxygen stable-isotope evidence from Greenland ice cores, is the sharpest, i.e. most rapid, and severest climatic fluctuation of the post-glacial period. Subsequent detailed pollen analytical investigations carried out on the relevant part of the core as identified in the preliminary investigations have shown (a) a shift in woodland composition in favour of birch and pine (both cold-tolerant trees) at the expense of hazel and oak (both thermophilous), (b) a more open woodland structure and (c) a substantial decline in pollen production at 8.2 ka. These changes leave no doubt but that this part of Sligo experienced a substantial climatic downturn — it is suggested that mean annual temperatures were

depressed by at least 2°C for probably a century or more — and a shift towards more continental-type climate, i.e. drier and colder, especially in winter, at about 8200 years ago.

The detailed results, including evidence of other early Holocene climate anomalies and the implications of the findings for the 8.2 ka event in wider contexts, are discussed in Ghilardi and O'Connell (2012).

Reference

Ghilardi, B. and O'Connell, M. 2012. Early Holocene vegetation and climate dynamics with particular reference to the 8.2 ka event: pollen and macrofossil evidence from a small lake in western Ireland. *Vegetation History and Archaeobotany*, DOI: 10.1007/s00334-012-0367-x

IQUA new web site

Francis Ludlow, has published a brand new IQUA website which deserves a special thank you as well as a big congratulations for all the hard work that has gone in to setting it up. The web site is a fantastic source of information for academics, amateurs, governmental and industrial partners with interest in Irish landscape change during the most recent period of the Quaternary. All events and information relating to IQUA's publications, conferences and field meetings are displayed on the web site. See www.iqua.ie for more information. For matters relating to the IQUA website, please contact Francis Ludlow (ludlowf@tcd.ie).

INQUA Humans and Biosphere

The new INQUA Humans and Biosphere (HAB COMM) web site please has recently been launched and can be accessed at <http://chrono.qub.ac.uk/habcom/>

Nicki Whitehouse is now President of this Commission would like to ask IQUA members to let her know if they would like to be added to there mailing list. They regularly send out newsletters with information on their activities plus details of INQUA funded opportunities.

Irish Geoscience Network

The Irish Geosciences Network, of which IQUA is a member, met for the first time this spring. The

Network was founded under the auspices of the Institute of Geologists of Ireland and comprises a dozen associations. The purpose of the Network is to try and work more closely together, for instance in areas of education and policy. The first practical gain of this is a comprehensive calendar which lists events organised by the different associations and which can be accessed through the website of the IGI (www.igi.ie)

***The Galway Geology Association (GGA), 'An Cumann Geolaíochta na Gaillimhe'.
The genesis and growth of a new Geology Association ***



Those of you from the west of the country and who have an interest in geology will be happy to hear of the foundation last September of the Galway Geology Association

(GGA), 'An Cumann Geolaíochta na Gaillimhe'. The association grew out of the past membership of the Earth Science evening diploma courses in both geology and gemmology, conducted by the National University of Ireland Galway (NUIG); courses which continue to be conducted. The close contact between the GGA and the College has been retained; Earth and Ocean Science, NUIG, allow the GGA the use of their facilities for meetings and lectures. With a growing membership, now in excess of 40, the GGA will commence its new season on 25 September, 2012. As was the case with last year, activities for 2012/13 will centre on monthly talks/presentations, fieldtrips and courses, both of a one day/weekend and a longer variety.

Dr. Allesandra (Alex) Costanzo of the Earth and Ocean Sciences, NUIG, and who is a prominent member of the GGA will again run a course this coming season in *An Fuarán*, the Moycullen Adult Education Centre. This course which is hosted by the County Galway Vocational Educational Committee will be conducted under the auspices of the GGA. Last year's course - 'Introduction to Earth Sciences: Geology' - was conducted on one night a week over 20 weeks and all attendees became active members of the GGA. The exact format and theme of this year's course has yet to be decided.

The Association will formally launch its programme for 2012/13 at its first meeting for the coming season on Tues evening, 25th September, in the main lecture hall, Earth and Ocean Sciences, The Quad, NUIG and to which all are welcome. The GGA membership ranges from the professional geologist through the amateur to those who wish for a little knowledge to enhance a walk through our beautiful countryside. Members travel from as far afield as Sligo, Castlebar and Mullingar and range in age from 4 years (family membership) to 84.



The fossil *Phanerotinus cristatus* was adopted as our emblem after founder member Pat Flaherty discovered two of these rare fossils, which inspired his idea for the GGA logo. There were previously only nine recorded specimens of *P. cristatus*, five from Ireland and four from the UK. (Wyse Jackson et.al. Irish Journal of Earth Sciences, 2000;18:113-122)

For more information check the GGA out at www.galwaygeology.weebly.com or contact the secretary (Pat Muldoon) at galwaygeology@gmail.com.

8. Past Events

ESOF Dublin, City of Science 2012

Field trip: Dublin in the grip of an ice age - a bus tour of the Wicklow Mountains.

Date: Saturday, 19th May 2012.

Organised by Pete Coxon as IQUA contribution to the Dublin City of Science programme. <http://www.dublinscience2012.ie/2012/05/dublin-in-the-grip-of-an-ice-age/>

Pete Coxon, Fraser Mitchell and Patrick Wyse Jackson who are experts in landscape and vegetation history from a variety of scientific backgrounds lead a fascinating tour of the Dublin and Wicklow Mountains as part of the ESOF Dublin City of Science. The day involved a bus tour (starting at Nassau Street in central Dublin) and stops included the northern edge of the Wicklow Mountains, Lough Bray, The Liffey Head Bog, Lough Tay viewpoint, (lunch in Roundwood), Glendalough, Lough Nahanagan and Hollywood

Glen. The leaders provided many exciting and insightful explanations of how the landscape has come to look the way it does, the forests of the last 10,000 years and their clearance and what the future may hold. The area around Dublin and Wicklow abounds with the evidence of these huge changes in climate. The trip also included a demonstration of peat coring as well as an exploration into the formation of the large glacial features in the region's landscape including glacial corries, huge glacial lake basins and other glacial and geomorphological features.

A wonderfully illustrated guide outlining the day's tour has been published by IQUA with sponsorship from Wicklow County Council and is available to purchase at: <http://www.iqua.ie/>



Pete Coxon and Patrick Wyse Jackson in the Wicklow Mountains at the Dublin in the grip of an ice age bus tour

The impact of ice sheet and ocean interactions on climate change

<http://esof2012.sched.org/venue/The+Liffey+A?iframe=yes&w=990&sidebar=yes&bg=no#sched-body-outer>

Steve McCarron convened this session which explored research in the North Atlantic region and showed that the Irish continental shelf is a critical area for climatic research. Among other themes the speakers discussed the potential that a rapidly melting Greenland Ice Sheet could force unexpected and rapid climatic change in the North Atlantic region.

Speakers

Colm O'Cofaigh, Durham University, UK
Hans Petter Sejrup, University of Bergen, Norway
Paul Dunlop, University of Ulster, UK

Sara Benetti, University of Ulster, UK

Environmental archaeology walking tour of Dublin City Centre by the Irish Palaeoecology and Environmental Archaeology Network (IPEAN)

Date: Thursday, 12th July 2012.

Organised by Bettina Steffanini as IPEAN contribution to the Dublin City of Science programme. <http://www.dublinscience2012.ie/2012/07/environmental-archaeology-walking-tour-of-dublin-city-centre-2/>

A very well attended and exciting tour of the Viking and medieval heart of Dublin city took place as part of the Dublin City of Science week. The tour gave some fresh insights and perspectives on this part of Medieval Dublin from an environmental archaeology background. The tour was given by Bettina Stefanini and Nikolah Gilligan.

*** Geoscience 2012 Conference***

An excellent conference was organised by the GSI in Dublin Castle in April 2012. The general themes of the conference were water (both surface and groundwater) and hazards in the urban environment from the perspective of the public sector and industry. On the second day the Tellus Border Project held its annual seminar in the morning and the GSI and Marine Institute reported on recent highlights along with updates on infrastructural projects and INFORMAR, the national marine mapping programme.

*** Russell Coope Memorial Talks ***

Scott Elias and Nicki Whitehouse hosted a day of talks in Royal Holloway, London to commemorate Prof Russell Coope who died on 26th November 2011. Russell pioneered the use of fossil beetles to reconstruct environmental conditions. The conference was excellent and well attended. Delegates heard how his interests and work went far beyond environmental reconstruction and how they continue to inspire a new generation of palaeoentomologists.

9. Forthcoming workshops, seminars & conferences

As many of you will know, Frank Mitchell was born 100 years ago on October 15th 1912. IQUA would really appreciate ideas on how we could celebrate the centenary. (The RSAI Mitchell Memorial Lecture, on October 25th, will be about Frank Mitchell and will be given by Michael Ryan.). Any ideas please contact Bettina Stefanini at stefanb@tcd.ie

Futures and Pasts: archaeological science on Irish road schemes will take place on Thursday 23 August at the City Wall Space, Wood Quay Venue, Dublin Civic Offices, Dublin 8. This year's seminar is the NRA's contribution to the Dublin City of Science 2012 Public Engagement Programme. To register please contact Lillian Butler at +353 1 6602511 or lbutler@nra.ie

Ireland in a Roman World An International and Interdisciplinary Conference Robert Emmet Theatre, Trinity College Dublin, 20-21 October 2012

The Discovery Programme is proud to announce the first international interdisciplinary conference that will consider how communities in Ireland engaged with the Roman world. Invited leading academics are from Ireland, England, Scotland, Germany, Denmark and the USA to present papers from across the subjects of Archaeology, History, Classics, Earth Sciences, Iron Age studies and 'Celtic' Studies, covering the Iron Age through to Late Antiquity

10. Recent Publications

Becker, K., Armit, I., Eogan, J. and Swindles, G.T. 2012. Later prehistoric radiocarbon dates from Ireland: an audit. *Journal of Irish Archaeology* 19, 19-25.

Carden RF, McDevitt AD, Zachos FE, Woodman PC, O'Toole P, Rose H, Monaghan NT, Campana MG, Bradley DG, Edwards CJ (2012).

Phylogeographic, ancient DNA, fossil and morphometric analyses reveal ancient and modern introductions of a large mammal: the complex case of red deer (*Cervus elaphus*) in Ireland. *Quaternary Science Reviews* 42: 74-84.

Farroqui, A., Kumar, A. and Swindles, G.T. 2012. Thecamoebian communities as proxies of seasonality in lake sediments in the Ganga-Yamuna Plains of North India. *Palaeontologia Electronica* 15 (1), 3A, 19p.

Ghilardi, B. and O'Connell, M. 2012. Early Holocene vegetation and climate dynamics with particular reference to the 8.2 ka event: pollen and macrofossil evidence from a small lake in western Ireland. *Vegetation History and Archaeobotany*, DOI: 10.1007/s00334-012-0367-x

Knight, J. 2011. Drumlin formation in a confined bedrock valley, northwest Ireland. *Boreas*, 40 (2), 289-302.

Knight, J. and Burningham, H. 2011. Boulder dynamics on an Atlantic-facing coastline, northwest Ireland. *Marine Geology*, 283 (1-4), 56-65.

Knight, J. and Harrison, S. 2011. Climate and landscape change. *Town & Country Planning*, 80 (12), 552-555.

Knight, J. 2011. Discussion of megaclast transport and erosion of rocky shorelines: a comment on Williams (2010). *Irish Journal of Earth Sciences*, 29, 23-24.

Knight, J. and Burningham, H. 2011. Sand dune morphodynamics and prehistoric human occupation in NW Ireland. In: Brown, A.G., Basell, L.S. and Butzer, K.W. (eds) *Geoarchaeology, Climate Change and Sustainability*. Geological Society of America Special Paper 476, 81-92.

Knight, J. 2011. Uses and limitations of field mapping of lowland glaciated landscapes. In: Smith, M.J., Paron, P. and Griffiths, J. (eds) *Geomorphological Mapping: a handbook of techniques and applications*, Elsevier, London, 529-546.

Knight, J., Mitchell, W.A. and Rose, J. 2011. Geomorphological field mapping. In: Smith, M.J., Paron, P. and Griffiths, J. (eds) *Geomorphological Mapping: a handbook of techniques and applications*, Elsevier, London, 151-187.

Lawson, I.T., Swindles, G.T., Plunkett, G. and Greenberg, D. 2012. The spatial distribution of Holocene cryptotephra in north-west Europe since 7 ka: implications for understanding ash fall events from Icelandic eruptions. *Quaternary Science Reviews* 41, 57-66.

Masselink, G., Hughes, M.G. and Knight, J. 2011. *Introduction to Coastal Processes and Geomorphology* (2nd edition). Hodder, London, ISBN 978-1-44412-240-4.

Rea, H.A., Swindles, G.T. and Roe, H.M. 2012. The Hekla 1947 tephra in the North of Ireland: distribution, concentration and geochemistry. *Journal of Quaternary Science* 27, 425-431.

Rushworth, G., Swindles, G.T. and Taylor, T. 2012. Late Quaternary vegetation history of Attermire, Yorkshire Dales. In: O'Regan, H.J., Faulkner, T. and Smith, I.R. (eds.) *Cave Archaeology and Karst Geomorphology of North West England: Field Guide*. Quaternary Research Association. London, 151-153

Smith, M.J. and Knight, J. 2011. Palaeoglaciology of the last Irish Ice Sheet reconstructed from striae evidence. *Quaternary Science Reviews*, 30, 147-160.

Swindles, G.T., Patterson, R.T., Roe, H.M. and Galloway, J.M. 2012. Evaluating periodicities in peat-based climate proxy records. *Quaternary Science Reviews* 41, 94-103.

Swindles, G.T., Taylor, T.F. and Rushworth, G. 2012. Cave sediments from the Attermire-Horseshoe complex, Yorkshire Dales. *Quaternary Newsletter* 126, 58-63.

Wilson, P., Westley, K., Plets, R. & Dempster, M. 2011. Radiocarbon dates from the inter-tidal peat bed at Portrush, County Antrim. *Irish Geography* 44, 323-329.

Wilson, P. 2011. Re-interpretation of the 'relict protalus rock glacier' at Grasmoor End, northwest Lake District. *North West Geography* 11(2), 1-6.

Wilson, P. & Smith, A. 2012. A sub-lateral boulder moraine in Dunnerdale, SW Lake District. *Proceedings, Cumberland Geological Society* 8, 69-80.

Wilson, P., Lord, T.C. & Vincent, P.J. 2012. Origin of the limestone pedestals at Norber Brow, North

Yorkshire, UK: a re-assessment and discussion. *Cave and Karst Science* 39, 5-11.

Wilson, P., Lord, T.C., Barrows, T.T. & Vincent, P.J. 2012. Cosmogenic isotope analysis and surface exposure dating in the Yorkshire Dales. In: O'Regan, H.J., Faulkner, T. & Smith, I.R. (eds), *Cave Archaeology and Karst Geomorphology of North West England: Field Guide*. Quaternary Research Association, London, 117-135.

Wilson, P., Telfer, M.W., Lord, T.C. & Vincent, P.J. 2012. Loessic sediments in northwest England. In: O'Regan, H.J., Faulkner, T. & Smith, I.R. (eds), *Cave Archaeology and Karst Geomorphology of North West England: Field Guide*. Quaternary Research Association, London, 143-150.

11. General Membership Items

Please let your students/colleagues know about IQUA and encourage them to join.

Join/Renew IQUA membership online via PayPal

We encourage all our members to update their annual subscription for 2012.

IQUA now offers a fast, safe, online payment system already familiar to many (**PayPal**) for joining IQUA or renewing your membership (!), and for purchasing past field guides (where available). The annual membership cost is: €15 waged; €10 students/unwaged.

PayPal allows you to pay securely with your credit/debit card via the IQUA website:

<http://www.iqua.ie/membership.html>

Simply click on the relevant "Pay Now" button and follow the on-screen instructions. Upon completing the process, you will receive a confirmation receipt from PayPal, and shortly thereafter confirmation from the Treasurer of your membership status.

For the convenience of members, we are also offering a three-year membership option with automatic billing. PayPal will automatically debit your credit/debit card each year for the relevant amount (either €15 or €10). This happens each year on the date you initially join/renew. To try this

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option, click on the relevant "Subscribe" button. You can cancel the automatic billing any time before the three-year period is up by contacting the Treasurer.

If you do not have access to our online PayPal system, which is our preferred method of dues collection, please cut out and complete the following form and send it with the relevant annual subscription (€15 waged; €10 students and unwaged) to the IQUA Treasurer at the address below.

Cheques should be made payable to IQUA. It is suggested that, for their convenience, members may wish to pay two or three years' subscription in a single transaction.

<p><i>IQUA membership form</i></p> <p>Name:</p> <p>Address:</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>Telephone:</p> <p>E-Mail:</p> <p>Amount paid:</p>

If you have any queries about IQUA membership, please contact the Treasurer.

Gayle McGlynn, IQUA Treasurer

Email: mcglyng@tcd.ie

Address: Department of Geography, Museum Building, Trinity College Dublin.

IQUA e-mail listserver:

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If you are not receiving IQUA listserv emails, please sign up to the list at the location above. A request for subscription to the IQUA-L list goes initially to

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B. Stefanini, IQUA-L Moderator

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